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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/787,094	03/13/2001	Martijn Jeroen Dekker	PHN 17.550	1104

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EXAMINER	
BATTAGLIA, MICHAEL V	

ART UNIT	PAPER NUMBER
2652	

DATE MAILED: 12/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/787,094	DEKKER ET AL.	
	Examiner	Art Unit	
	Michael V Battaglia	2652	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *13 March 2001*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-22* is/are rejected.

7)☒ Claim(s) *23-25* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. §§ 119 and 120

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

13)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

a) ☐ The translation of the foreign language provisional application has been received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *30*.
4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Specification

The following guidelines illustrate the preferred layout for the specification of a utility application. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

As provided in 37 CFR 1.77(b), the specification of a utility application should include the following sections in order. **Each of the lettered items should appear in upper case, without underlining or bold type, as a section heading.** If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

(a) TITLE OF THE INVENTION.
(b) CROSS-REFERENCE TO RELATED APPLICATIONS.
(c) STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT.
(d) INCORPORATION-BY-REFERENCE OF MATERIAL SUBMITTED ON A COMPACT DISC (See 37 CFR 1.52(e)(5) and MPEP 608.05. Computer program listings (37 CFR 1.96(c)), "Sequence Listings" (37 CFR 1.821(c)), and tables having more than 50 pages of text are permitted to be submitted on compact discs.) or
REFERENCE TO A "MICROFICHE APPENDIX" (See MPEP § 608.05(a). "Microfiche Appendices" were accepted by the Office until March 1, 2001.)
(e) BACKGROUND OF THE INVENTION.
(1) Field of the Invention.
(2) Description of Related Art including information disclosed under 37 CFR 1.97 and 1.98.
(f) BRIEF SUMMARY OF THE INVENTION.
(g) BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S).
(h) DETAILED DESCRIPTION OF THE INVENTION.
(i) CLAIM OR CLAIMS (commencing on a separate sheet).
(j) ABSTRACT OF THE DISCLOSURE (commencing on a separate sheet).
(k) SEQUENCE LISTING (See MPEP § 2424 and 37 CFR 1.821-1.825. A "Sequence Listing" is required on paper if the application discloses a nucleotide or amino acid sequence as defined in 37 CFR 1.821(a) and if the required "Sequence Listing" is not submitted as an electronic document on compact disc).

2. The abstract of the disclosure is objected to because the abstract contains references to figures. The examiner suggests removing the reference numbers and "Fig. 1" from the abstract. Correction is required. See MPEP § 608.01(b).

Claim Objections

Claims 23-25 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claims 23-25 are drawn to a recording medium and therefor do not further limit the recording device of claim 13, 16, or 18. Claims 23-25 are otherwise withdrawn from further consideration.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 1, 4, 9, 12, 15, and 20 are rejected under 35 U.S.C. 102(e) as being anticipated by Yamada et al (hereafter Yamada) (US 6,153,063).

In regard to claim 1, Yamada discloses a method of recording marks representing data in a recording medium, said recording medium comprising an information layer having a phase which

is reversibly changeable between a crystal phase and an amorphous phase, by irradiating the information layer with a pulsed radiation beam (Col. 13, lines 53-58), each mark being written by a sequence of pulses comprising at least one write pulse (Col. 25, lines 39-40), the written marks being erasable by irradiating the information layer with a radiation beam having an erase power level (e) (Fig. 7, power of the crystallizing pulse and Col. 14, lines 15-21), a first write pulse of a sequence of pulses being preceded by a cooling pulse having a cooling power level (c) which is lower than the erase power level (e), said radiation beam being generated by a radiation source (Col. 25, lines 10-11), characterized in that a last write pulse of a sequence is directly followed by a rear heating pulse having a rear heating power level (r), the rear heating power level (r) being higher than the erase power level (e) (Fig. 8(E)). The examiner notes that in Fig. 8(E), the claimed cooling power level is the lowest power level, the claimed erase power level is the middle power level, and the claimed rear heating power level is the highest power level and at the same level as the write power level. The sequence of write pulses is made up of the second half of the first pulse at the write power level, the two thin pulses in the middle of the pulses at the write power level, and the first half of the last pulse at the write power level. The claimed cooling pulse is the first pulse at the cooling power level after the first pulse at the erase power level. The claimed rear heating pulse is the second half of the last pulse at the write/rear heating power level.

In regard to claim 4, Yamada discloses that the first write pulse of a sequence is directly preceded by a front heating pulse having a front heating power level (f), the front heating pulse being directly preceded by the cooling pulse having a cooling power level (c), the front heating power level (f) being higher than the erase power level (e) (Fig. 8(E)). The examiner notes that the claimed front heating power level is at the same level as the write power level and the rear heating

power level. The claimed front heating pulse is the first half of the first pulse at the write/front heating power level.

In regard to claim 9, Yamada discloses that the rear heating pulse, which is the rear portion of the last pulse, includes a front portion having the rear heating power level (r), and a rear portion having a power level which is lower than the erase power level (e) (Fig. 8(E)). The examiner notes that the rear portion of the rear heating pulse is the pulse at the cooling power level that immediately follows the front portion of the rear heating pulse.

In regard to claim 12, Yamada discloses a recording device for recording data in the form of marks on a recording medium, said recording medium comprising an information layer having a phase which is reversibly changeable between a crystal phase and an amorphous phase, by irradiating the information layer with a pulsed radiation beam (Col. 13, lines 53-58), the recorded marks being erasable by means of irradiating the information layer with a radiation beam having an erase power level (e) (Fig. 7, power of the crystallizing pulse and Col. 14, lines 15-21), the device comprising a radiation source providing the radiation beam and a control unit for controlling the power of the radiation beam (Col. 25, lines 10-11 and 19-20), the control unit being operative for providing a sequence of write pulses for writing a mark and controlling the power of the radiation beam such that it has a cooling power level (c) which is lower than the erase power level (e) preceding a first write pulse of a sequence of pulses, characterized in that the control unit is operative for controlling the power of the radiation beam such that it has a rear heating pulse having a rear heating power level (r) directly following a last write pulse of a sequence, the rear heating power level (r) being higher than the erase power level (e) (Fig. 8(E)). The examiner notes that in Fig. 8(E), the claimed cooling power level is the lowest power level, the claimed erase power level is the middle power level, and the claimed rear heating power level is the highest power level

and at the same level as the write power level. The sequence of write pulses is made up of the second half of the first pulse at the write power level, the two thin pulses in the middle of the pulses at the write power level, and the first half of the last pulse at the write power level. The claimed cooling pulse is the first pulse at the cooling power level after the first pulse at the erase power level. The claimed rear heating pulse is the second half of the last pulse at the write/rear heating power level.

In regard to claim 15, Yamada discloses that the control unit is operative for controlling the power of the radiation beam such that it has a front heating pulse having a front heating power level (f) directly preceding a first write pulse and a cooling pulse having a cooling power level (c) directly preceding the front heating pulse, the front heating power level (f) being higher than the erase power level (e) and the cooling power level (c) being lower than the erase power level (e) (Fig. 8(E)). The examiner notes that the claimed front heating power level is at the same level as the write power level and the rear heating power level. The claimed front heating pulse is the first half of the first pulse at the write/front heating power level.

In regard to claim 20, Yamada discloses that the control unit is operative for providing the rear heating pulse and controlling the power of the radiation beam such that the rear heating pulse includes a front portion having the rear heating power level (r), and a rear portion having a power level which is lower than the erase power level (e) (Fig. 8(E)). The examiner notes that the rear portion of the rear heating pulse is the pulse at the cooling power level that immediately follows the front portion of the rear heating pulse.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1, 3, 4, 6, 9, 12, 14, 15, 17, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Furukawa et al (hereafter Furukawa) (US 6,345,026) in view of Takada et al (hereafter Takada) (US 5,818,808).

In regard to claim 1, Furukawa discloses a method of recording marks representing data in a recording medium, said recording medium comprising an information layer having a phase which is reversibly changeable between a crystal phase and an amorphous phase, by irradiating the information layer with a pulsed radiation beam (Col. 1, lines 28-47 and 62-64), each mark being written by a sequence of pulses comprising at least one write pulse (Figs. 6(i) and 6(j)), the written marks being erasable by irradiating the information layer with a radiation beam having an erase power level (e) (Fig. 5, element 32 and Col. 5, line 39), said radiation beam being generated by a radiation source (Fig. 5, element 65), characterized in that a last write pulse of a sequence is directly followed by a rear heating pulse having a rear heating power level (r), the rear heating power level (r) being higher than the erase power level (e) (Fig. 6(i)). The examiner notes in Fig. 6(i), the claimed erase power level is the power level in between the pulse trains; the claimed rear heating power level is shown by s, w, or z; the claimed last write pulse of a sequence is the front portion of the pulses having the power level s, w, or z; the claimed rear heating pulse is the rear portion of the pulse having the power level s, w, or z; and the claimed first write pulse of a

sequence of pulses is the rear portion of the pulse having the power level m, e, or i. Furukawa discloses a cooling power level (c) which is lower than the erase power level (e) (Fig. 8(k), power level shown after the rear heating pulse), but does not disclose that a cooling pulse having the cooling power level (c) precedes the first write pulse of a sequence of pulses.

Takada discloses using a cooling pulse having a cooling power level (c), which is lower than the erase power (e), preceding the first write pulse of a sequence of pulses to suppress thermal interference with the preceding mark (Fig. 6B, elements Pb and Pe and Col. 10, lines 44-49).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a cooling pulse having a cooling power level (c) which is lower than the erase power level (e) preceding the first write pulse of a sequence of pulses of Furukawa as suggested by Takada, the motivation being to suppress thermal interference with the preceding mark.

In regard to claim 3, Furukawa in view of Takada as applied to claim 1 discloses a method as claimed in claim 1. Furukawa discloses that the method is for recording marks having lengths of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1, each mark being written by a sequence of (n-1) write pulses (Figs. 6(a), 6(b), and 6(i)). The examiner notes that the write pulses for each mark are the rear portion of the first pulse, the thin middle pulses (for marks larger than 3T), and the front portion of the last pulse. The write pulses are characterized in that rear heating pulse has a second rear heating power level (r2) when n=3 and a third rear heating power level (r3) when $n \geq 4$ (Col. 10, Table 4). Further, the second rear heating power level (r2) and the third rear heating power level (r3) are dependent on properties of the recording medium. The examiner notes that the recording medium has a property that causes thermal interference and poor bit error rates

when spaces between marks are short because the heat from a recorded mark affects the temperature increase at the starting-end of the mark next to be recorded (Col. 1, line 65 - Col. 2, line 6). The rear heating power levels are adjusted to compensate for the aforementioned property of the recording medium (Col. 9, line 59 - Col. 10, line 3). Furukawa uses an eight-fourteen modulation (EFM) scheme and therefor does not have marks of length n=2 or a corresponding rear heating power level.

Takada discloses a method of recording marks representing data in a recording medium that is compatible with EFM code with the n=2 mark lengths of a (1,7) run-length limited (RLL) modulation code (Col. 17, lines 39-43). Takada teaches that being compatible with RLL modulation is beneficial because RLL modulation code is generally employed in a peripheral unit of a computer and an optical recording medium (Col. 17, lines 43-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the method of Furukawa compatible with the n=2 length marks of RLL modulation code as suggested by Takada, the motivation being to be compatible with a commonly used alternative modulation scheme. It then would have also been obvious to one of ordinary skill in the art at the time the invention was made to handle the n=2 length mark in the same fashion as the n=3 through 11 length marks in the method of Furukawa and have a rear heating power level for the n=2 length mark, the motivation being to improve bit error rates and compensate for thermal interference that results from short spaces between marks in higher density recording mediums.

In regard to claim 4, Furukawa discloses that the first write pulse of a sequence is directly preceded by a front heating pulse having a front heating power level (f), the front heating power level (f) being higher than the erase power level (e) (Fig. 6(i)). The examiner notes that in Fig. 6(i),

the claimed front heating power level is m, e, or i. The claimed front heating pulse is the front portion of the pulse having the power level m, e, or i. The cooling pulse of Takada having a cooling power level (c) directly precedes the front heating pulse (Fig. 6B).

In regard to claim 6, Furukawa in view of Takada as applied to claim 4 discloses the method of claim 4. Furukawa discloses that the method is for recording marks having lengths of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1, each mark being written by a sequence of (n-1) write pulses (Figs. 6(a), 6(b), and 6(i)). The examiner notes that the write pulses for each mark are the rear portion of the first pulse, the thin middle pulses (for marks larger than 3T), and the front portion of the last pulse. The write pulses are characterized in that front heating pulse has a second front heating power level (f2) when n=3 and a third front heating power level (f3) when n≥4 (Col. 10, Table 3). Further, the second front heating power level (f2) and the third front heating power level (f3) are dependent on properties of the recording medium. The examiner notes that the recording medium has a property that causes thermal interference and poor bit error rates when spaces between marks are short because the heat from a recorded mark affects the temperature increase at the starting-end of the mark next to be recorded (Col. 1, line 65 - Col. 2, line 6). The rear heating power levels are adjusted to compensate for the aforementioned property of the recording medium (Col. 9, line 59 - Col. 10, line 3). Furukawa uses an eight-fourteen modulation (EFM) scheme and therefor does not have marks of length n=2 or a corresponding front heating power level.

Takada discloses a method of recording marks representing data in a recording medium that is compatible with EFM code with the n=2 mark lengths of a (1,7) run-length limited (RLL) modulation code (Col. 17, lines 39-43). Takada teaches that being compatible with RLL

modulation is beneficial because RLL modulation code is generally employed in a peripheral unit of a computer and an optical recording medium (Col. 17, lines 43-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the method of Furukawa compatible with the n=2 length marks of RLL modulation code as suggested by Takada, the motivation being to be compatible with a commonly used alternative modulation scheme. It then would have also been obvious to one of ordinary skill in the art at the time the invention was made to handle the n=2 length mark in the same fashion as the n=3 through 11 length marks in the method of Furukawa and have a front heating power level for the n=2 length mark, the motivation being to improve bit error rates and compensate for thermal interference that results from short spaces between marks in higher density recording mediums.

In regard to claim 9, Furukawa discloses that the rear heating pulse includes a front portion having the rear heating power level (r), and a rear portion having a power level which is lower than the erase power level (e) (Fig. 8(k) and Col. 12, lines 45-51). The examiner notes that the rear portion of the rear heating pulse is the pulse at the cooling power level that immediately follows the front portion of the rear heating pulse at the rear heating power level of s, w, or z.

In regard to claim 12, Furukawa discloses a recording device for recording data in the form of marks on a recording medium, said recording medium comprising an information layer having a phase which is reversibly changeable between a crystal phase and an amorphous phase, by irradiating the information layer with a pulsed radiation beam (Col. 1, lines 28-47 and 62-64), the recorded marks being erasable by means of irradiating the information layer with a radiation beam having an erase power level (e) (Fig. 5, element 32 and Col. 5, line 39), the device comprising a radiation source providing the radiation beam (Fig. 5, element 65) and a control unit for

controlling the power of the radiation beam (Fig. 5, element 71), the control unit being operative for providing a sequence of write pulses for writing a mark and controlling the power of the radiation beam such that it has a cooling power level (c) which is lower than the erase power level (e) preceding a first write pulse of a sequence of pulses, characterized in that the control unit is operative for controlling the power of the radiation beam such that it has a rear heating pulse having a rear heating power level (r) directly following a last write pulse of a sequence, the rear heating power level (r) being higher than the erase power level (e) (Fig. 6(i)). The examiner notes in Fig. 6(i), the claimed erase power level is the power level in between the pulse trains; the claimed rear heating power level is shown by s, w, or z; the claimed last write pulse of a sequence is the front portion of the pulses having the power level s, w, or z; the claimed rear heating pulse is the rear portion of the pulse having the power level s, w, or z; and the claimed first write pulse of a sequence of pulses is the rear portion of the pulse having the power level m, e, or i. Furukawa discloses a cooling power level (c) which is lower than the erase power level (e) (Fig. 8(k), power level shown after the rear heating pulse), but does not disclose that a cooling pulse having the cooling power level (c) precedes the first write pulse of a sequence of pulses.

Takada discloses using a cooling pulse having a cooling power level (c), which is lower than the erase power level (e), preceding the first write pulse of a sequence of pulses to suppress thermal interference with the preceding mark (Fig. 6B, elements Pb and Pe and Col. 10, lines 44-49).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a cooling pulse having a cooling power level (c) which is lower than the erase power (e) preceding the first write pulse of a sequence of pulses of Furukawa as suggested by Takada, the motivation being to suppress thermal interference with the preceding mark.

In regard to claim 14, Furukawa in view of Takada as applied to claim 12 discloses a recording device as claimed in claim 12. Furukawa discloses that the recording device is for recording marks having lengths of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1 (Figs. 6(a), 6(b), and 6(i)). The examiner notes that the write pulses for each mark are the rear portion of the first pulse, the thin middle pulses (for marks larger than 3T), and the front portion of the last pulse. The write pulses are characterized in that rear heating pulse has a second rear heating power level (r2) when n=3 and a third rear heating power level (r3) when n≥4 (Col. 10, Table 4). Further, the second rear heating power level (r2) and the third rear heating power level (r3) are dependent on properties of the recording medium. The examiner notes that the recording medium has a property that causes thermal interference and poor bit error rates when spaces between marks are short because the heat from a recorded mark affects the temperature increase at the starting-end of the mark next to be recorded (Col. 1, line 65 - Col. 2, line 6). The rear heating power levels are adjusted to compensate for the aforementioned property of the recording medium (Col. 9, line 59 - Col. 10, line 3). Furukawa uses an eight-fourteen modulation (EFM) scheme and therefor does not have marks of length n=2 or a corresponding rear heating power level.

Takada discloses a recording device that is compatible with EFM code with the n=2 mark lengths of a (1,7) run-length limited (RLL) modulation code (Col. 17, lines 39-43). Takada teaches that being compatible with RLL modulation is beneficial because RLL modulation code is generally employed in a peripheral unit of a computer and an optical recording medium (Col. 17, lines 43-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the recording device of Furukawa compatible with the n=2 length marks of RLL modulation code as suggested by Takada, the motivation being to be compatible with a commonly used alternative modulation scheme. It then would have also been obvious to one of ordinary skill in the art at the time the invention was made to handle the n=2 length mark in the same fashion as the n=3 through 11 length marks in the recording device of Furukawa and have a rear heating power level for the n=2 length mark, the motivation being to improve bit error rates and compensate for thermal interference that results from short spaces between marks in higher density recording mediums.

In regard to claim 15, Furukawa discloses that the control unit is operative for controlling the power of the radiation beam such that it has a front heating pulse having a front heating power level (f) directly preceding a first write pulse and a cooling pulse having a cooling power level (c) directly preceding the front heating pulse, the front heating power level (f) being higher than the erase power level (e) and the cooling power level (c) being lower than the erase power level (e) (Fig. 6(i)). The examiner notes that in Fig. 6(i), the claimed front heating power level is m, e, or i. The claimed front heating pulse is the front portion of the pulse having the power level m, e, or i. The cooling pulse of Takada having a cooling power level (c) directly precedes the front heating pulse (Fig. 6B).

In regard to claim 17, Furukawa in view of Takada as applied to claim 15 discloses the recording device of claim 15. Furukawa discloses that the recording device is for recording marks having lengths of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1 (Figs. 6(a), 6(b), and 6(i)). The examiner notes that the write pulses for each mark are the rear portion of the first pulse, the

thin middle pulses (for marks larger than 3T), and the front portion of the last pulse. The write pulses are characterized in that front heating pulse has a second front heating power level (f2) when n=3 and a third front heating power level (f3) when n≥4 (Col. 10, Table 3). Further, the second front heating power level (f2) and the third front heating power level (f3) are dependent on properties of the recording medium. The examiner notes that the recording medium has a property that causes thermal interference and poor bit error rates when spaces between marks are short because the heat from a recorded mark affects the temperature increase at the starting-end of the mark next to be recorded (Col. 1, line 65 - Col. 2, line 6). The rear heating power levels are adjusted to compensate for the aforementioned property of the recording medium (Col. 9, line 59 - Col. 10, line 3). Furukawa uses an eight-fourteen modulation (EFM) scheme and therefor does not have marks of length n=2 or a corresponding front heating power level.

Takada discloses a recording device that is compatible with EFM code with the n=2 mark lengths of a (1,7) run-length limited (RLL) modulation code (Col. 17, lines 39-43). Takada teaches that being compatible with RLL modulation is beneficial because RLL modulation code is generally employed in a peripheral unit of a computer and an optical recording medium (Col. 17, lines 43-45).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the recording device of Furukawa compatible with the n=2 length marks of RLL modulation code as suggested by Takada, the motivation being to be compatible with a commonly used alternative modulation scheme. It then would have also been obvious to one of ordinary skill in the art at the time the invention was made to handle the n=2 length mark in the same fashion as the n=3 through 11 length marks in the recording device of Furukawa and have a front heating power level for the n=2 length mark, the motivation being to improve bit error

rates and compensate for thermal interference that results from short spaces between marks in higher density recording mediums.

In regard to claim 20, Furukawa discloses that the control unit is operative for providing the rear heating pulse and controlling the power of the radiation beam such that the rear heating pulse includes a front portion having the rear heating power level (r), and a rear portion having a power level which is lower than the erase power level (e) (Fig. 8(k) and Col. 12, lines 45-51). The examiner notes that the rear portion of the rear heating pulse is the pulse at the cooling power level that immediately follows the front portion of the rear heating pulse at the rear heating power level of s, w, or z.

6. Claims 2, 5, 7, 13, 16, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Furukawa in view of Takada as applied to claims 1, 3, 4, 6, 9, 12, 14, 15, 17, and 20 above and in further view of Kirino et al (hereafter Kirino) (US 5,590,111).

In regard to claim 2, Furukawa in view of Takada discloses a method as claimed in claim 1 having a rear heating pulse that has a rear heating power level (r). Furukawa in view of Takada does not disclose that the rear heating power level (r) of the rear heating pulse is dependent on properties of the recording medium.

Kirino discloses a rear heating power level (Fig. 19B, element P_{W2}) that is dependent upon the properties of a recording medium (Col. 15, line 62 - Col. 16, line 10). Kirino teaches that finding optimum recording power levels for a recording medium will ensure reliable recording and reproduction (Col. 5, lines 24-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the rear heating power level of Furukawa dependent on properties of

the recording medium as suggested by Kirino, the motivation being to ensure reliable recording and reproduction.

In regard to claim 5, Furukawa in view of Takada discloses a method as claimed in claim 1 having a front heating pulse that has a front heating power level (f). Furukawa in view of Takada does not disclose that the front heating power level (f) of the front heating pulse is dependent on properties of the recording medium.

Kirino discloses a front heating power level (Fig. 19B, element P_{W1}) that is dependent upon the properties of a record carrier (Col. 15, line 62 - Col. 16, line 10). Kirino teaches that finding optimum recording power levels for a recording medium will ensure reliable recording and reproduction (Col. 5, lines 24-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the front heating power level of Furukawa dependent on properties of the recording medium as suggested by Kirino, the motivation being to ensure reliable recording and reproduction.

In regard to claim 7, Furukawa in view of Takada discloses a method as claimed in claim 4 having a cooling pulse that has a cooling power level (c). Furukawa in view of Takada does not disclose that the cooling power level (c) is dependent on properties of the radiation source and the recording medium.

Kirino discloses a cooling power level (Fig. 19B, element P_R) that is dependent upon the properties of a radiation source and a recording medium (Col. 15, line 62 - Col. 16, line 10). The examiner notes that the radiation source is part of the apparatus used for recording and therefor, the method of Kirino accounts for the properties of the radiation source. Kirino teaches that

finding optimum recording power levels for a recording medium will ensure reliable recording and reproduction (Col. 5, lines 24-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the cooling power level of Furukawa dependent on properties of the recording medium as suggested by Kirino, the motivation being to ensure reliable recording and reproduction.

In regard to claim 13, Furukawa in view of Takada discloses a recording device as claimed in claim 12 having a rear heating pulse that has a rear heating power level (r). Furukawa in view of Takada does not disclose that the recording device comprises a means for determining a value for the rear heating power level (r) that depends on properties of the recording medium.

Kirino discloses a recording device that has a means for determining a value for the rear heating power level (Fig. 19B, element P_{W2}) that depends on properties of the recording medium (Fig. 19A and Col. 15, line 62 - Col. 16, line 10). Kirino teaches that finding optimum recording power levels that are dependent on properties of the recording medium will ensure reliable recording and reproduction (Col. 5, lines 24-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the means for determining a value for the rear heating power level that is dependent on properties of the recording medium into the recording device of Furukawa as suggested by Kirino, the motivation being to ensure reliable recording and reproduction.

In regard to claim 16, Furukawa in view of Takada discloses a recording device as claimed in claim 15 having a front heating pulse that has a front heating power level (f). Furukawa in view

of Takada does not disclose that the recording device comprises a means for determining a value for the front heating power level (f) that depends on properties of the recording medium.

Kirino discloses a recording device that has a means for determining a value for the front heating power level (Fig. 19B, element P_{WI}) that depends on properties of the recording medium (Fig. 19A and Col. 15, line 62 - Col. 16, line 10). Kirino teaches that finding optimum recording power levels that are dependent on properties of the recording medium will ensure reliable recording and reproduction (Col. 5, lines 24-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the means for determining a value for the front heating power level that is dependent on properties of the recording medium into the recording device of Furukawa as suggested by Kirino, the motivation being to ensure reliable recording and reproduction.

In regard to claim 18, Furukawa in view of Takada discloses a recording device as claimed in claim 15 having a cooling pulse that has a cooling power level (c). Furukawa in view of Takada does not disclose that the recording device comprises a means for determining a value for the cooling power level (c) that depends on properties of the recording medium.

Kirino discloses a recording device that has a means for determining a value for the cooling power level (Fig. 19B, element P_R) that depends on properties of the recording medium (Fig. 19A and Col. 15, line 62 - Col. 16, line 10). Kirino teaches that finding optimum recording power levels that are dependent on properties of the recording medium will ensure reliable recording and reproduction (Col. 5, lines 24-42).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the means for determining a value for the cooling power level

that is dependent on properties of the recording medium into the recording device of Furukawa as suggested by Kirino, the motivation being to ensure reliable recording and reproduction.

7. Claims 1, 4, 8, 10-12, 15, 19, and 21-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Furukawa in view of Tanaka.

In regard to claim 1, Furukawa discloses a method of recording marks representing data in a recording medium, said recording medium comprising an information layer having a phase which is reversibly changeable between a crystal phase and an amorphous phase, by irradiating the information layer with a pulsed radiation beam (Col. 1, lines 28-47 and 62-64), each mark being written by a sequence of pulses comprising at least one write pulse (Figs. 6(i) and 6(j)), the written marks being erasable by irradiating the information layer with a radiation beam having an erase power level (e) (Fig. 5, element 32 and Col. 5, line 39), said radiation beam being generated by a radiation source (Fig. 5, element 65), characterized in that a last write pulse of a sequence is directly followed by a rear heating pulse having a rear heating power level (r), the rear heating power level (r) being higher than the erase power level (e) (Fig. 6(i)). The examiner notes that in Fig. 6(i), the claimed erase power level is the power level in between the pulse trains; the claimed rear heating power level is shown by s, w, or z; the claimed last write pulse of a sequence is the front portion of the pulses having the power level s, w, or z; the claimed rear heating pulse is the rear portion of the pulse having the power level s, w, or z; and the claimed first write pulse of a sequence of pulses is the rear portion of the pulse having the power level m, e, or i. Furukawa discloses a cooling power level (c) which is lower than the erase power level (e) (Fig. 8(k), power level shown after the rear heating pulse), but does not disclose that a cooling pulse having the cooling power level (c) precedes the first write pulse of a sequence of pulses.

Tanaka discloses using a cooling pulse having a cooling power level (c), which is lower than the erase power level (e), preceding the first write pulse of a sequence of pulses and teaches that doing so will form a sharp edge at the beginning of the recording mark (Fig. 8, elements Pb and Pae and Col. 8, lines 56-59).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a cooling pulse having a cooling power level (c) which is lower than the erase power (e) preceding the first write pulse of a sequence of pulses of Furukawa as suggested by Tanaka, the motivation being to form a sharp edge at the beginning of the recording mark.

In regard to claim 4, Furukawa discloses that the first write pulse of a sequence is directly preceded by a front heating pulse having a front heating power level (f), the front heating power level (f) being higher than the erase power level (e) (Fig. 6(i)). The examiner notes that in Fig. 6(i), the claimed front heating power level is m, e, or i. The claimed front heating pulse is the front portion of the pulse having the power level m, e, or i. The cooling pulse of Tanaka having a cooling power level (c) is at the beginning of a sequence of write pulses of a recording mark (Fig. 8 and Col. 8, lines 56-59) and therefor, directly precedes the front heating pulse.

In regard to claim 8, Furukawa in view of Tanaka discloses the method as claimed in claim 4. Furukawa discloses that the method is for recording marks having lengths of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1, each mark being written by a sequence of (n-1) write pulses (Figs. 6(a), 6(b), and 6(i)). The cooling pulses of Tanaka are characterized in that the cooling pulse has a first cooling power level (c1) when n=2, a second cooling power level (c2) when n=3, and a third cooling power level (c3) when $n \geq 4$ (Fig. 8, element Pb). The examiner notes that c1=c2=c3=Pb. Tanaka discloses that the first cooling power level (c1), the second cooling power

level (c2), and the third cooling power level (c3) are dependent on properties of the radiation source and the recording medium (Fig. 18 and Col. 10, lines 65 - Col. 11, line 12). The examiner notes that the cooling power levels are dependent on pattern shift, thermal shift, and recording power margin, all of which are dependent on the properties of the radiation source and the recording medium.

In regard to claim 10, Furukawa discloses a method of recording marks representing data in a recording medium, said recording medium comprising an information layer having a phase which is reversibly changeable between a crystal phase and an amorphous phase, by irradiating the information layer with a pulsed radiation beam (Col. 1, lines 28-47 and 62-64), each mark having a length of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1, the marks being written by a sequence of pulses comprising (n-1) write pulses (Figs. 6(a), 6(b), and 6(i)), the written marks being erasable by irradiating the information layer with a radiation beam having an erase power level (e) (Fig. 5, element 32 and Col. 5, line 39), said radiation beam being generated by a radiation source (Fig. 5, element 65). The examiner notes that in Fig. 6(i), the claimed erase power level is the power level in between the pulse trains. Furukawa discloses a cooling power (c) which is lower than the erase power (e) (Fig. 8(k), power level shown after the rear heating pulse), but does not disclose that a cooling pulse having the cooling power (c) precedes the first write pulse of a sequence of pulses. In addition, Furukawa does not disclose that the cooling pulse is characterized by a first cooling power level (c1) when n=2, a second cooling power level (c2) when n=3, and a third cooling power level (c3) when $n \geq 4$, the first cooling power level (c1) the second cooling power level (c2), and the third cooling power level (c3) being dependent on properties the radiation source and of the recording medium.

Tanaka discloses using a cooling pulse having a cooling power level (c), which is lower than the erase power (e), preceding the first write pulse of a sequence of pulses and teaches that doing so will form a sharp edge at the beginning of the recording mark (Fig. 8, elements Pb and Pae and Col. 8, lines 56-59). The cooling pulses of Tanaka are characterized in that the cooling pulse has a first cooling power level (c1) when n=2, a second cooling power level (c2) when n=3, and a third cooling power level (c3) when n≥4 (Fig. 8, element Pb). The examiner notes that c1=c2=c3=Pb. Tanaka discloses that the first cooling power level (c1), the second cooling power level (c2), and the third cooling power level (c3) are dependent on properties of the radiation source and the recording medium (Fig. 18 and Col. 10, lines 65 - Col. 11, line 12). The examiner notes that the cooling power levels are dependent on pattern shift, thermal shift, and recording power margin, all of which are dependent on the properties of the radiation source and the recording medium.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to precede the first write pulse of a sequence of pulses of the method of Furukawa with a cooling pulse as characterized above and dependent on the properties of the radiation source and the recording medium as suggested by Tanaka, the motivation being to form a sharp edge at the beginning of the recording mark.

In regard to claim 11, Tankaa discloses that the first cooling power level (c1) is substantially equal to the second cooling power level (c2) and the third cooling power level (c3) (Fig. 8).

In regard to claim 12, Furukawa discloses a recording device for recording data in the form of marks on a recording medium, said recording medium comprising an information layer having a phase which is reversibly changeable between a crystal phase and an amorphous phase, by irradiating the information layer with a pulsed radiation beam (Col. 1, lines 28-47 and 62-64), the recorded marks being erasable by means of irradiating the information layer with a radiation beam

having an erase power level (e) (Fig. 5, element 32 and Col. 5, line 39), the device comprising a radiation source providing the radiation beam (Fig. 5, element 65) and a control unit for controlling the power of the radiation beam (Fig. 5, element 71), the control unit being operative for providing a sequence of write pulses for writing a mark and controlling the power of the radiation beam such that it has a cooling power level (c) which is lower than the erase power level (e) preceding a first write pulse of a sequence of pulses, characterized in that the control unit is operative for controlling the power of the radiation beam such that it has a rear heating pulse having a rear heating power level (r) directly following a last write pulse of a sequence, the rear heating power level (r) being higher than the erase power level (e) (Fig. 6(i)). The examiner notes in Fig. 6(i), the claimed erase power level is the power level in between the pulse trains; the claimed rear heating power level is shown by s, w, or z; the claimed last write pulse of a sequence is the front portion of the pulses having the power level s, w, or z; the claimed rear heating pulse is the rear portion of the pulse having the power level s, w, or z; and the claimed first write pulse of a sequence of pulses is the rear portion of the pulse having the power level m, e, or i. Furukawa discloses a cooling power level (c) which is lower than the erase power level (e) (Fig. 8(k), power level shown after the rear heating pulse), but does not disclose that a cooling pulse having the cooling power level (c) precedes the first write pulse of a sequence of pulses.

Tanaka discloses using a cooling pulse having a cooling power level (c), which is lower than the erase power level (e), preceding the first write pulse of a sequence of pulses and teaches that doing so will form a sharp edge at the beginning of the recording mark (Fig. 8, elements Pb and Pae and Col. 8, lines 56-59).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have a cooling pulse having a cooling power level (c) which is lower than the

erase power (e) preceding the first write pulse of a sequence of pulses of Furukawa as suggested by Tanaka, the motivation being to form a sharp edge at the beginning of the recording mark.

In regard to claim 15, Furukawa discloses that the control unit is operative for controlling the power of the radiation beam such that it has a front heating pulse having a front heating power level (f) directly preceding a first write pulse and a cooling pulse having a cooling power level (c) directly preceding the front heating pulse, the front heating power level (f) being higher than the erase power level (e) and the cooling power level (c) being lower than the erase power level (e) (Fig. 6(i)). The examiner notes that in Fig. 6(i), the claimed front heating power level is m, e, or i. The claimed front heating pulse is the front portion of the pulse having the power level m, e, or i. The cooling pulse of Tanaka having a cooling power level (c) is at the beginning of a sequence of write pulses of a recording mark (Fig. 8 and Col. 8, lines 56-59) and therefor, directly precedes the front heating pulse.

In regard to claim 19, Furukawa in view of Tanaka discloses the recording device as claimed in claim 15. Furukawa discloses that the recording device is for recording marks having lengths of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1 (Figs. 6(a), 6(b), and 6(i)). The cooling pulses of Tanaka are characterized in that the cooling pulse has a first cooling power level (c1) when n=2, a second cooling power level (c2) when n=3, and a third cooling power level (c3) when $n \geq 4$ (Fig. 8, element Pb). The examiner notes that c1=c2=c3=Pb. Tanaka discloses that the first cooling power level (c1), the second cooling power level (c2), and the third cooling power level (c3) are dependent on properties of the radiation source and the recording medium (Fig. 18 and Col. 10, lines 65 - Col. 11, line 12). The examiner notes that the cooling power levels are dependent

on pattern shift, thermal shift, and recording power margin, all of which are dependent on the properties of the radiation source and the recording medium.

In regard to claim 21, Furukawa discloses a recording device for recording data in the form of marks on a recording medium, said recording medium comprising an information layer having a phase which is reversibly changeable between a crystal phase and an amorphous phase (Col. 1, lines 28-47 and 57-64), and said marks having lengths of nT, where T represents the length of one period of a reference clock in a data signal and n represents a predetermined natural number larger than 1, by irradiating the information layer by a pulsed radiation beam (Figs. 6(a), 6(b), and 6(i)), the recorded marks being erasable by irradiating the information layer with a radiation beam having an erase power level (e) (Fig. 5, element 32 and Col. 5, line 39), the device comprising a radiation source providing the radiation beam (Fig. 5, element 65) and a control unit for controlling the power of the radiation beam (Fig. 5, element 71), the control unit being operative for providing a sequence of write pulses for writing a mark (Fig. 6(i)). The examiner notes that in Fig. 6(i), the claimed erase power level is the power level in between the pulse trains. Furukawa discloses controlling the power of the radiation beam such that it has a cooling power level (c) which is lower than the erase power (e) (Fig. 8(k), power level shown after the rear heating pulse), but does not disclose that a cooling pulse having the cooling power (c) precedes the first write pulse of a sequence of pulses. In addition, Furukawa does not disclose that the cooling pulse is characterized by a first cooling power level (c1) when n=2, a second cooling power level (c2) when n=3, and a third cooling power level (c3) when n≥4, the first cooling power level (c1) the second cooling power level (c2), and the third cooling power level (c3) being dependent on properties the radiation source and of the recording medium.

Tanaka discloses using a cooling pulse having a cooling power level (c), which is lower than the erase power (e), preceding the first write pulse of a sequence of pulses and teaches that doing so will form a sharp edge at the beginning of the recording mark (Fig. 8, elements Pb and Pae and Col. 8, lines 56-59). The cooling pulses of Tanaka are characterized in that the cooling pulse has a first cooling power level (c1) when n=2, a second cooling power level (c2) when n=3, and a third cooling power level (c3) when n≥4 (Fig. 8, element Pb). The examiner notes that c1=c2=c3=Pb. Tanaka discloses that the first cooling power level (c1), the second cooling power level (c2), and the third cooling power level (c3) are dependent on properties of the radiation source and the recording medium (Fig. 18 and Col. 10, lines 65 - Col. 11, line 12). The examiner notes that the cooling power levels are dependent on pattern shift, thermal shift, and recording power margin, all of which are dependent on the properties of the radiation source and the recording medium.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to precede the first write pulse of a sequence of pulses output from the recording device of Furukawa with a cooling pulse as characterized above and dependent on the properties of the radiation source and the recording medium as suggested by Tanaka, the motivation being to form a sharp edge at the beginning of the recording mark.

In regard to claim 22, Tanaka discloses that the first value for the cooling power level (c1) is substantially equal to the second value for the cooling power level (c2) and the third value for the cooling power level (c3) (Fig. 8).

Citation of Relevant Prior Art

8. Zhou et al (US 6,584,051) discloses storing recording parameters in an area of a phase change optical disc (Col. 6, lines 7-13). Miyamoto et al (US 6,236,635) discloses a sequence of

write pulses having front and rear heating pulses, a following cooling pulse, and adjusting the power level of the cooling power in between pulses (Fig. 12). Saga et al (US 6,104,685) (Fig. 6c) and Todo et al (US 6,272,100) (Fig. 3) disclose a sequence of write pulses having a preceding and a following cooling pulse, a front heating pulse, and (n-1) pulses for an nT mark.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael V Battaglia whose telephone number is (703) 305-4534. The examiner can normally be reached on 5-4/9 Plan with 1st Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Hoa T Nguyen can be reached on (703) 305-9687. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

Michael Battaglia

Michael Battaglia

W. R. YOUNG
PRIMARY EXAMINER